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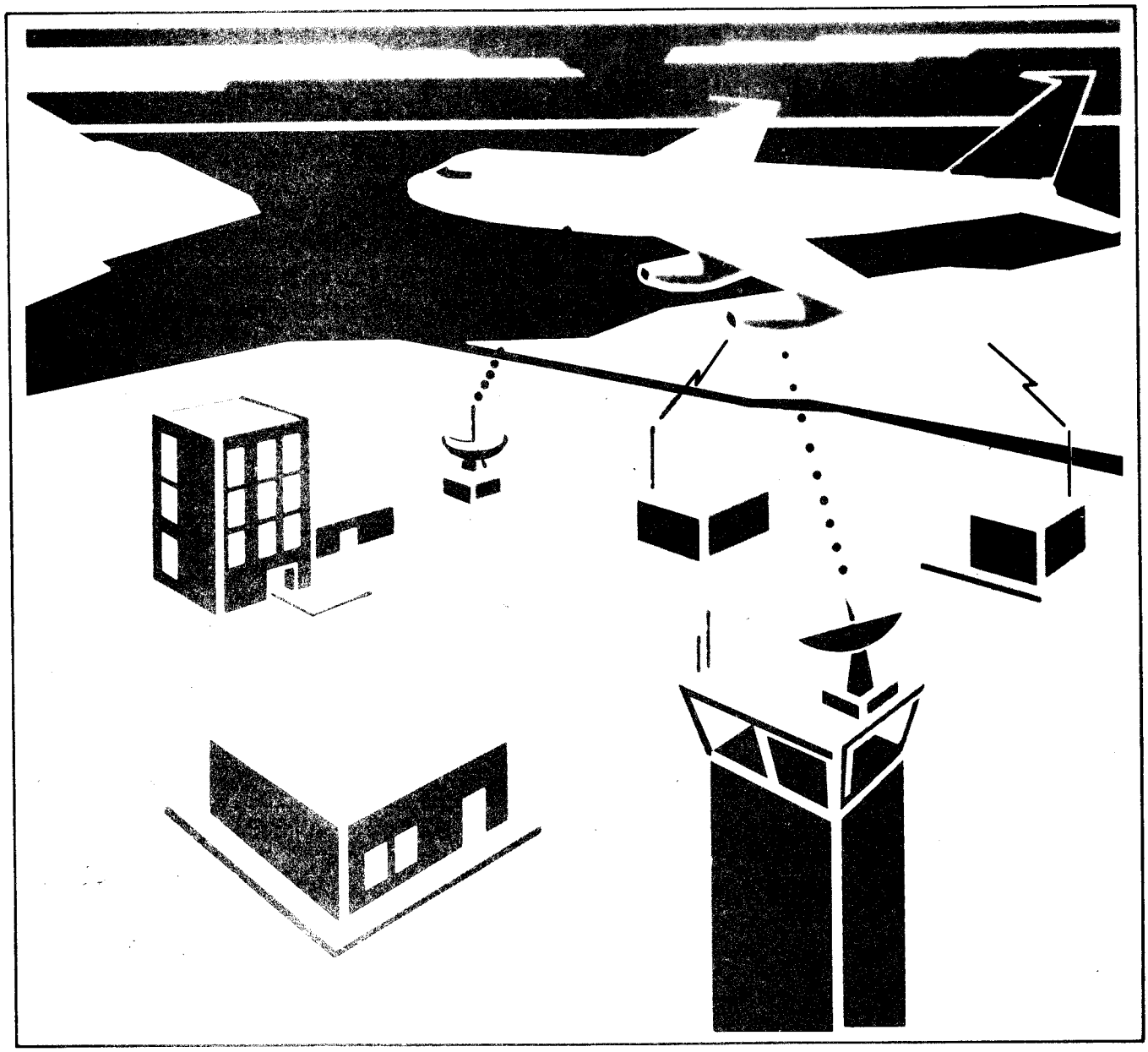
National Airspace System

Aircraft Separation Operational Concept NAS-SR-1323

U.S. Department of Transportation
Federal Aviation Administration



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16. Abstract

This document presents an operational concept for aircraft separation services which will be in place upon implementation of the Federal Aviation Administration (FAA) National Airspace System (NAS) Plan. This operational concept describes the relationship among subsystems, facilities, information, and operators/users involved in the aircraft separation per the NASSRS in terminal, en route, and oceanic airspaces which have radar coverage. The current automation functions as well as the additional automation features involved in the Automated En Route ATC (AERA) package pertaining to aircraft separation assurance are included.

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1.0 INTRODUCTION

1.1 Background

The mission of the air traffic control (ATC) system is to provide for the safe and efficient use of the nation's airspace. The first priority of ATC is to maintain safety in flight by separating aircraft in controlled airspace. The National Airspace System (NAS) System Requirements Specification (NASSRS), NAS-SR-1000, is a compilation of requirements which describe the operational capabilities of the NAS upon completion of the NAS Plan ("end-state" system).

This operational concept discusses aircraft separation per the NASSRS in terminal, en route, and oceanic airspaces which have radar coverage. This operational concept document has been developed using an established standard format and is consistent in structure and content with a series of operational concepts written about various sections of the NASSRS.

1.2 Objective

The objective of this operational concept is to describe the functions involved in aircraft separation in the NAS end-state system. More specifically, it shows the interrelationships between subsystems, facilities, information, and controllers/users. In addition, it provides management and technical personnel of the Federal Aviation Administration (FAA) and other involved organizations with a general description of how the aircraft separation service of the NAS operates.

1.3 Scope

This document covers the requirements delineated in Section 3.2.3 of the NASSRS. This document follows the NASSRS convention of calling the functions described in Section 3.2.3 of the NASSRS aircraft separation functions, although not all of the requirements in Section 3.2.3 are directly related to aircraft separation. The operations described are limited to those functions associated solely with radar coverage systems. In addition, it describes the handoff of aircraft from one jurisdiction to the next. The paragraphs in NASSRS Section 3.2.3 and titles are as follows:

3.2.3.A Acquire Actual Flight Information
3.2.3.B Acquire Flight Plan Information
3.2.3.C Flight Plan Association Checks

3.2.3.D Weather Information For Flight Path Prediction
3.2.3.E Detection of Air Defense Identification Zone (ADIZ) and Distant Early Warning Identification Zone (DEWIZ)
3.2.3.F Separation of Aircraft on Parallel Runways
3.2.3.G Provide Surveillance Coverage
3.2.3.H Display Controlled Aircraft Position & Related Data
3.2.3.I Display Geographic Information
3.2.3.J Tracking Performance Requirements
3.2.3.K Generate Clearances
3.2.3.L Detect Actual/Potential Aircraft Separation
3.2.3.M Generate Resolution Advisories
3.2.3.N Detect and Identify Conflicts
3.2.3.O Provide Aircraft Handoff
3.2.3.P Availability on a Continuous Basis

This document explains the maintenance of adequate aircraft separation in terminal, en route, and oceanic airspace systems which have radar coverage. It discusses for controlled aircraft, flight information, real time weather data, potential or actual reduction in separation, generation of clearances, and maneuvers recommended to maintain aircraft separation. Also discussed are the current automation functions as well as the additional automation features included in the Automated En Route Air Traffic Control (AERA) package pertaining to aircraft separation.

The Collision Avoidance Operational Concept (NAS-SR-1325) covers the requirements delineated in Section 3.2.5 of the NASSRS. As the NASSRS requirements in Sections 3.2.3 and 3.2.5 are similar, the topics covered in the Collision Avoidance Operational Concept and this operational concept are similar. The Collision Avoidance Operational Concept provides a more detailed view of AERA functions and functions which identify imminent conflicts.

This document does not include the following operations:

- The aircraft separation service required to support military operations. It is described in a separate document (Military Operations Support Operational Concept (NAS-SR-13210)).

- The aircraft separation service for ground and obstacle avoidance which describes minimum safe altitude resolutions. It is also described in a separate document (Ground and Obstacle Avoidance Operational Concept (NAS-SR-1327)).

- The aircraft separation service in non-radar airspace. It is described in a separate document (Control When Outside of Independent Surveillance Coverage Operational Concept (NAS-SR-1324)).

1.4 Methodology

This operational concept document provides information in a number of different ways. The material is centered around four different kinds of diagrams and/or descriptive information as given below:

1. Operational Block Diagram/Description. The operational block diagram illustrates the connectivity between major elements of the NAS, i.e., processors, specialists/controllers, and the user for those elements that support the service. The operational block diagram in this Operational Concept is extracted from the overall NAS Operational Block Diagram. Principal features of the operational block diagram/description include:

   a. Each specialist/controller is indicated by a number. This number remains the same in every operational concept.

   b. Dotted lines segregate facilities.

   c. Solid lines show digital data flow. Voice data flow is not shown.

   d. The blocks within each facility are the major processors.

2. Operational Flow Diagrams/Descriptions. The operational flow diagram and associated description for each specialist/controller provides detail about the inputs, processors, outputs, and interfaces for each operator. Operational flow diagrams functionally describe the products and services of individual specialists/controllers. The diagrams show major actions only. Ancillary actions such as requests for simulation and system conditions are not shown. Principal features of an operational flow diagram include:

   a. Dotted lines delineate facilities.

   b. Unshaded boxes indicate specialist/controller/user functions. Shaded boxes indicate machines.

   c. The functions listed by lower case alphabetic characters in the white and shaded boxes are explained in the text.

3. Operational Sequence Diagrams/Descriptions. The operational sequence diagram and associated descriptions show a typical sequence of steps taken by operators/users in providing the service. Principal features include:

a. Users and specialists/controllers involved with providing/using the service are listed along the vertical axis. For clarity, other FAA facilities may also be listed on the vertical axis.

b. The horizontal axis represents time. Sequential events or functions performed by an operator/user are indicated within separate boxes. Events which may occur simultaneously or near-simultaneously are indicated by the double number. The numbers on the right side of the blocks refer to numbers in the text.

c. Decision points or points where alternate paths may be followed are indicated by a diamond shape.

d. Circles are connectors and indicate exit to, or entry from, another diagram. Circles with a character connect either to another sheet of the same diagram or to another diagram, and the relevant figure number is listed underneath if connection is to a different diagram.

e. Functions within the boxes preceded by a lower case alphabetic character reference the same functions listed in the operational flow diagrams. Thus, the relationship between operator/user interactions and relevant NAS subsystems is depicted.

4. Operational Scenario(s)/Description(s). The operational scenario and associated description depict a specific predefined situation and illustrate a particular subset of the generalized operational sequence diagrams. Principal features include:

a. Users and specialists/controllers involved with providing the service are listed along the vertical axis.

b. The horizontal axis represents time. Sequential events or functions performed by an operator/user are indicated within separate boxes. The numbers on the right side of the blocks refer to numbers in the text.

c. Shaded portions of boxes represent machine actions.

1.5 Document Organization

The remainder of this document is organized as follows. Section 2 is the main body of the document and is divided into six subsections. Section 2.1 provides an operational block diagram illustrating the

connectivity between subsystems, facilities, operators, and users that are involved in aircraft separation. It also provides an operational summary of each position. Section 2.2 describes the information required or used to provide aircraft separation. Section 2.3 expands the functions performed at each position in operational flow diagrams and provides more detail about inputs, processes, outputs, and the interface with the user. It also summarizes NAS subsystems functions. Section 2.4 correlates the NASSRS with this document. Section 2.5 presents generalized time-sequenced operator/user interactions for Area Control Facility (ACF) controllers and the Airport Traffic Control Tower (ATCT) controllers. Section 2.6 provides a scenario to illustrate a specific hypothetical situation where aircraft separation services are provided.

2.0 OPERATIONS

2.1 Support

Major functions of aircraft separation operations are supported by the Area Control Computer Complex (ACCC), Flight Service Automation System (FSAS), Flight Service Data Processing System (FSDPS), Real-time Weather Processor (RWP), Data Link Processor (DLP), Tower Control Computer Complexes (TCCC), Voice Switching And Control System (VSCS), Air Traffic Control Radar Beacon System (ATCRBS), Automatic Dependent Surveillance (ADS), Altitude-Encoded Beacon Reply (Mode C) and Mode Select Beacon System (Mode S) transponders, and controllers. NAS subsystems that contain processing capabilities or position equipment that support operational services to maintain separation are discussed in Section 2.3, Functions.

Figure 2-1 illustrates the NAS facilities, systems, and user systems that are involved with the aircraft separation functions.

2.1.1 NAS Facilities/Systems/Positions

The NAS facilities, systems, specialist positions, and major information paths that may be involved in aircraft separation are shown in Figure 2-2. The functions provided by each specialist position and a description of each follows. Included with each description is a reference to the existing procedures manual and to those NAS projects that are most likely to affect how the service is provided.

Position 6: Approach/Departure Controllers (ACF Controllers)
Function: Ensure aircraft separation in controlled airspace within the assigned area of responsibility.
Description: Approach/departure controllers ensure aircraft safety by maintaining separation minima. They provide in-flight assistance, weather avoidance services, clearance delivery, minimum safe altitude warning (MSAW) resolutions, and conflict resolution advisories (CRA). They also take action to transfer and accept control responsibilities from one jurisdiction to the next.

Procedures: FAA, "Air Traffic Control" (7110.65); Chapter 5, Sections 2 through 9, 14, and 15.

Projects: NAS Plan, En Route Systems

Project 4, En Route Automated Radar Tracking System (EARTS) Enhancements
Project 5, Oceanic Display and Planning System (ODAPS)
Project 7, Modern ATC Host Computer
Project 9, CRA Function

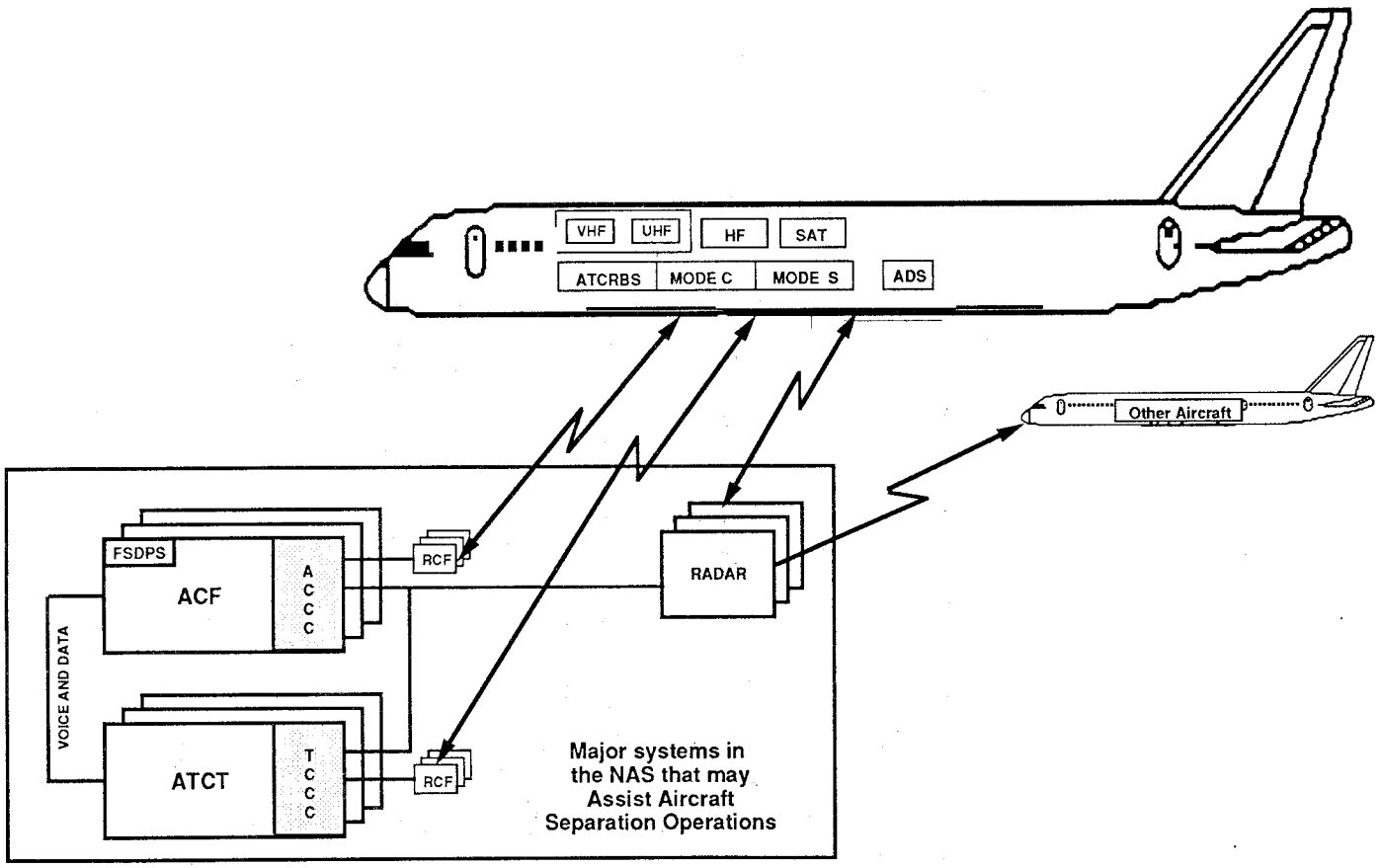


FIGURE 2-1
OVERVIEW OF NAS/USER SYSTEMS FOR AIRCRAFT SEPARATION

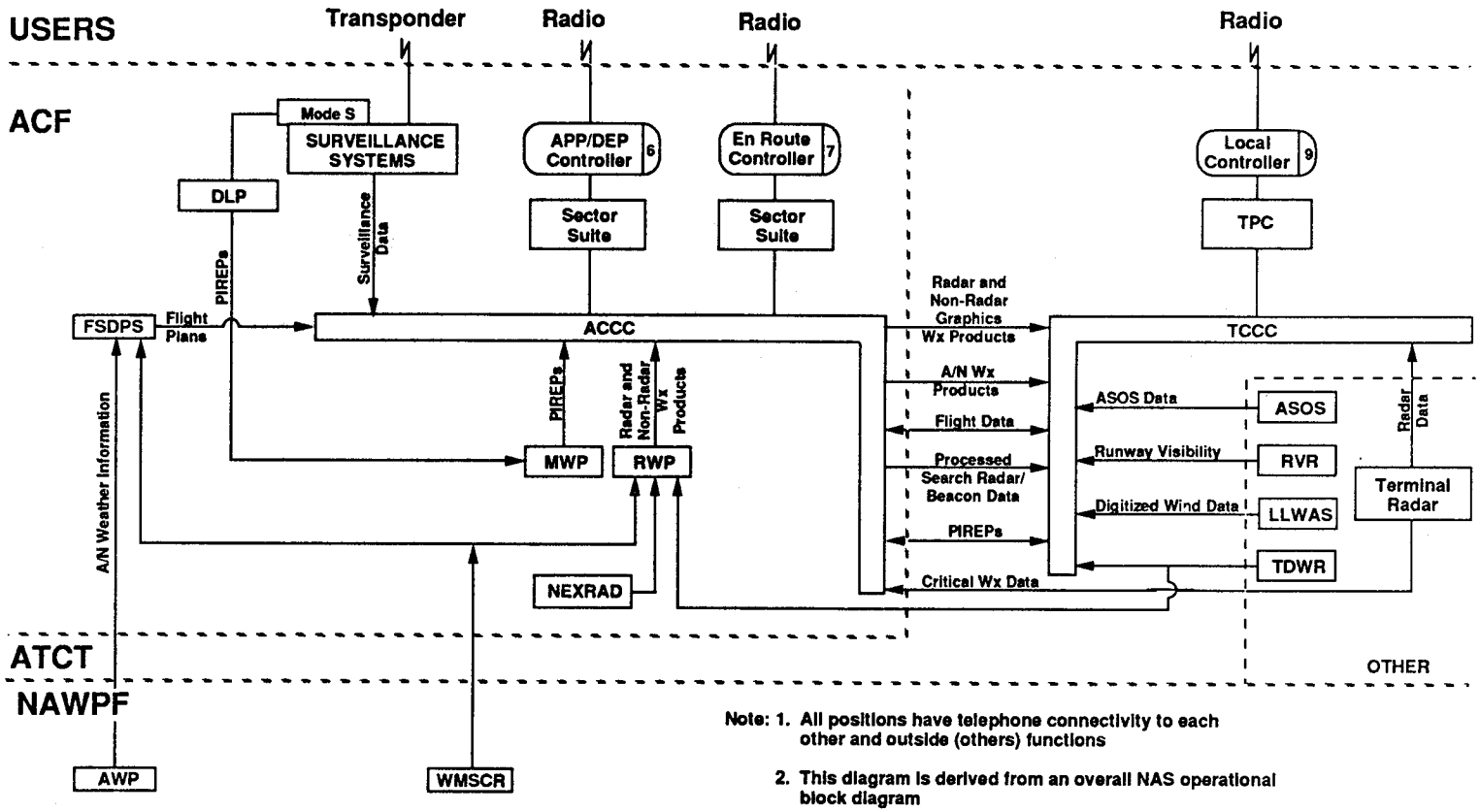


FIGURE 2-2
AIRCRAFT SEPARATION OPERATIONAL BLOCK DIAGRAM

Project 10, Conflict Alert (CA) Instrument Flight Rules (IFR)/Visual Flight Rules (VFR) Mode C Intruder
Project 12, Advanced Automation System (AAS)
Project 13, AERA
Project 15, ACFs

NAS Plan, Flight Service and Weather System

Project 1, FSAS
Project 2, Central Weather Processor (CWP)
Project 5, Weather Communications Processor (WCP)/Data Link
Project 9, Automated Weather Observing System (AWOS)
Project 12, Low Level Wind Shear Alert System (LLWAS)

NAS Plan, Ground-to-Air System

Project 8, Runway Visual Range (RVR)
Project 12, Mode S
Project 13, Terminal Radar Program
Project 14, Airport Surface Detection Equipment (ASDE 3) Radar
Project 15, Long-Range Radar Program
Project 16, Weather Radar Program
Project 18, Terminal Doppler Weather Radar System (TDWR)

Position 7: En Route Controllers (ACF Controllers)
Function: Ensure aircraft separation in controlled airspace within assigned area of responsibility.
Description: En route controllers ensure aircraft safety by maintaining separation minima. En route controllers provide the same basic functions to maintain separation as approach and departure controllers except that their control areas, separation criteria, and separation techniques are somewhat different.

Procedures: Same as position 6 above.

Projects: Same as position 6 above.

Position 9: Local Controllers (ATCT Controllers)
Functions: Ensure aircraft separation for takeoff and landing.
Description: Local controllers are located at ATCTs. They are supported by the TCCC through the TCCC Position Console (TPC). They issue takeoff and landing clearances, and advise which runway to use for landing or takeoff. They also provide departure and arrival spacing, sequencing, in-flight assistance, real time weather data, and CRAs to maintain

separation standards. For controlled aircraft, they transfer control to, or accept control from an approach/departure controller or en route controller (depending on airport).

Procedures: FAA, "Air Traffic Control" (7110.65); Chapters 2, 3, 4, 6, 7, and 8.

Projects: NAS Plan, Terminal Automation

Project 1, Enhanced Terminal CA
Project 12, Tower Communication System (TCS)
Project 13, ATCT/Terminal Radar Approach Control (TRACON) Establishment, Replacement, and Modernization

NAS Plan, Ground-to-Air System

Project 8, RVR
Project 13, Terminal Radar (Airport Surveillance Radar (ASR)) Program
Project 18, TDWR

NAS Plan, Flight Service and Weather System

Project 9, AWOS
Project 12, LLWAS

2.1.2 User Systems

Figure 2-1 shows two way radio systems for voice communications (Very High Frequency (VHF), Ultra High Frequency (UHF), High Frequency (HF)), data communications (Satellite, Mode C, and Automatic Communications Addressing and Reporting System (ACARS)), and systems to assist in surveillance (ATCRBS, Mode S, and ADS). Few, if any aircraft have all of these systems, but almost all have some.

2.2 Information

The information generated or used in the processes associated with aircraft separation can be categorized as follows:

- Information generated/displayed through the ACCC
- Information generated/displayed through the TCCC

The following paragraphs elaborate on specific information provided by the ACCC and TCCC systems. The pertinent NASSRS paragraphs that specify the information generated/displayed through the ACCC/TCCC (NAS subsystem) are referred to in the paragraphs below.

2.2.1 Information Generated/Displayed Through the ACCC

Information that the specialist needs is provided by the ACCC, and is generated and displayed by the sector suites. Information also includes messages that are provided to the controllers to change data contained in the system data base. Controllers receive information associated with aircraft separation as follows:

a. Track Control. Track data message information pertaining to aircraft separation is as follows:

- Track Message. The track status message enables the controller to manually drop or start the tracking function for a particular aircraft.

NASSRS requirements: 3.2.3.A.1.f
3.2.3.C.6
3.2.3.J
3.2.3.H.6

- Vertical Velocity Readout. This message enables the controllers to display the vertical velocity of an aircraft.

NASSRS requirements: 3.2.3.C.1.e
3.2.3.H.1.d

- Collision Risk Assessment Messages. The situation display presents CA and CRA information to controllers. These alerts result from surveillance processing and include aircraft-to-aircraft violations, special use airspace violations, as well as alerts resulting from the monitoring of aircraft-to-terrain (MSAW) parameters. The ACCC will display at least one resolution advisory maneuver for each predicted violation. The controllers can suppress/restore the display of CA, MSAW, and CRA information.

NASSRS requirements: 3.2.3.L.4
3.2.3.L.7
3.2.3.H.2
3.2.3.M

- Geographic Data Messages. The controllers can display Full Data Blocks (FDB) for aircraft. The geographic map data includes, but is not limited to several groups of fixes, airways, sector boundaries (grouped by altitude), special use airspace boundaries, airports, minimum vector altitudes, military routes, holding pattern airspace (grouped by airport runway configuration), and others. The controller can emphasize/de-emphasize the display of the geographic map data.

NASSRS requirements: 3.2.3.I

- Handoff Messages. If automatic handoff is not initiated or inhibited, the handoff message enables controllers to manually initiate the transfer of radar identification of an aircraft from one sector controller to another. A retract handoff message provides the means for the initiating controller to take back a handoff.

NASSRS requirements: 3.2.3.O

- Reminder List. The reminder list includes aircraft call sign information to remind the controller to perform a control action which was planned in the trajectory. The information is displayed prior to the starting point of a maneuver.

NASSRS requirements: 3.2.3.C.5

b. Flight Data. The flight data and messages pertaining to aircraft separation are as follows:

- Flight Data Amendment. This message is used to modify, add to, or delete previously entered flight data for any flight plan.

NASSRS requirements: 3.2.3.B

- Progress Report. This message is used to update the aircraft position in time for an active flight plan.

NASSRS requirements: 3.2.3.A.3

- Reported Altitude. This message is used to enter, modify, or delete a reported altitude.

NASSRS requirements: 3.2.3.A.1.E

- Transfer Flight Plan. This message is used to cause the transmission of flight plan data to a facility (ACCC, or TCCC).

NASSRS requirements: 3.2.3.B.1

- Request Flight Data Entries (FDEs). This message allows the controller to request one or more FDEs from another sector and/or facility to be displayed in the Flight Data Area at the requesting sector.

NASSRS requirements: 3.2.3.H.4

- FDE Point Out. This function is used to display a FDE at a sector which has an interest in the aircraft's position, but would not normally receive an FDE based on the aircraft's normal route of flight. The display has the capacity to show flight plan information for a minimum of 50 aircraft per sector.

NASSRS requirements: 3.2.3.H.(3 & 5)

- Runway Assignment. This message is used to assign or reassign a runway to an aircraft.

NASSRS requirements: 3.2.3.I.2

- Approach Type. This message is used to identify the type of approach (e.g., instrument landing system approach, visual approach, contact approach, touch and go, and various military approaches) an aircraft is going to make to a runway.

NASSRS requirements: 3.2.3.F

- Flight Plan. This message is used to enter flight plan data into the system for a flight. The controllers may request the display of the planned route of any aircraft on the situation display for which flight plan information is available. They can also suppress/restore the display of FDBs and associated FDEs from all displays.

NASSRS requirements: 3.2.3.B
3.2.3.H (1, 2, & 3)

- Implement Reroute. This message is used to enter a proposed reroute into a flight plan or trial plan, after the controller/ACCC has determined that the new route will satisfy a flow restriction.

NASSRS requirements: 3.2.3.B.3

- Create/Delete Route. This message is used to create or delete a route or route segment. If a route identifier is not entered, the system automatically assigns a route identifier to the designated route or route segment.

NASSRS requirements: 3.2.3.B.7

c. Traffic Management Data. The traffic management data includes a traffic management advisory list, which contains flow restrictions, and a metering advisories list. The data assists the controller in properly spacing aircraft at a rate which can be accepted by adjacent ATC facilities or airports.

NASSRS requirements: 3.2.3.k.1.b

d. Weather Data. The en route and approach/departure controllers are provided with the following weather products; radar graphic, non-radar graphic, alphanumeric text, and pilot weather reports. The radar products include those supplied by the RWP which consists of the Next Generation Weather Radar (NEXRAD) products, and those various products from weather channels of surveillance radars which include terminal ASR-9 radar products. The alphanumerical text products are generated by the National Weather Service (NWS) Center Weather Service Unit Meteorologist (CWSUM), the National Aviation Weather Advisory Unit (NAWAU), or automatically by local systems (e.g., Automated Surface Observing System (ASOS)). The radar graphic products include a number of mosaic maps depicting precipitation, turbulence, and storm parameters. The alphanumeric products include surface observations, terminal and area forecasts, convective outlooks, hurricane advisories, convective and non-convective Significant Meteorological Information (SIGMETS), Airman's Meteorological Information (AIRMETS), center weather statements, and center weather advisories. The pilot reports (PIREPS) include winds and temperatures aloft. In general the products are for the ACF area plus 150 nautical miles (nmi).

NASSRS requirements: 3.2.3.D

e. Automation Processing Data. Automation processing data and messages required to ensure aircraft separation are as follows:

- Trial Plan Build/Amend. The controllers can create a trial plan. They can also modify, add to, or delete information from a previously entered trial plan.

NASSRS requirements: 3.2.3.B.6

- Retrieve Plan. The controllers can retrieve a previously stored trial plan or flight plan for trial plan processing.

NASSRS requirements: 3.2.3.H.6

- Implement Trial Plan. The controllers can establish a new flight plan from a trial plan or replace an existing flight plan for an aircraft.

NASSRS requirements: 3.2.3.C.2

- AERA Alert Messages. The AERA alerts result from violations of the strategic (20-minute look-ahead) time parameter and include aircraft-to-aircraft, aircraft-to-airspace, and flow restriction violations. Alerts resulting from flight plan trajectory information are classified as priority (need immediate attention) and advisory (may need future attention). Alerts resulting from trial plan trajectory processing are referred to as Trial Plan Alerts.

NASSRS requirements: 3.2.3.L.5

- Quick Trial Planning. The controllers can initiate quick trial planning to construct up to four trial plans. The trial plans are based on the type of maneuver specified by the controllers. The maneuver type includes altitude change, lateral route offset, speed change, and vectors.

NASSRS requirements: 3.2.3.C (3 & 4)

- Reconformance Aid. The controllers can construct a trial plan to restore conformance between an aircraft's vertical and lateral track position and its flight plan.

NASSRS requirements: 3.2.3.C.4

2.2.2 Information Generated/Displayed Through the TCCC

Information provided by the TCCC is generated and displayed on the logical displays and includes messages to change data contained in the system data base. The information given to the controllers associated with aircraft separation is:

a. Track Data. The TCCC track data and messages are the same as the ACCC's stated in Section 2.2.1.a; except that the reminder list and the aircraft conflict data are not presented to the TCCC TPC. The data provided are:

- Track Message
- Vertical Velocity Readout
- Collision Risk Assessment Messages
- Geographic Data Messages
- Handoff Messages

b. Flight Data. The TCCC flight data and messages are the same as the ACCC's stated in Section 2.2.1.b; except implement reroute, and create/delete route are not presented to the TCCC TPC. The data provided are:

- Flight Data Amendment
- Progress Report
- Reported Altitude
- Transfer Flight Plan
- Request FDEs
- FDE Point Out
- Runway Assignment
- Approach Type
- Flight Plan

c. Traffic Management Data. The TCCC traffic management data are similar to the ACCC's stated in Section 2.2.1.c; that is, a traffic management advisory list and a metering advisory list. In addition, the following messages are included:

- Runway configuration list. This list displays runway configurations, basic weather, demand, and airport status information.

- Departure flow list. This list contains information and advisory data calculated by the Departure Flow Management function (it regulates the flow and the rate of aircraft departures appropriate to that airspace at a certain fix).

NASSRS requirements: 3.2.3.B.4
3.2.3.K.1.b

d. Weather data. Weather products for the immediate terminal area include relevant ACCC alphanumeric products, and alphanumeric and graphic products generated by the sensors and systems installed at that airport. At a typical large airport the sensors and systems would include the ASR-9 terminal radar, TDWR, RVR, LLWAS, and ASOS. The products include wind shear/microburst alerts and such basic observations as ceiling and prevailing visibility. When the TCCC receives an ACCC product that reports a hazardous weather condition, (e.g., SIGMET) an alert is displayed to the controller.

2.3 Functions

The following paragraphs elaborate on functions provided by the controller positions and supporting equipment. The operational flow diagrams illustrate the information flow between the controller and the user, and between the controller and data processing equipment. The focus is on functions specifically related to the aircraft separation service. Pertinent NASSRS paragraphs specifying the functions performed by the controllers are referred to below.

2.3.1 Functions of Approach/Departure Controllers

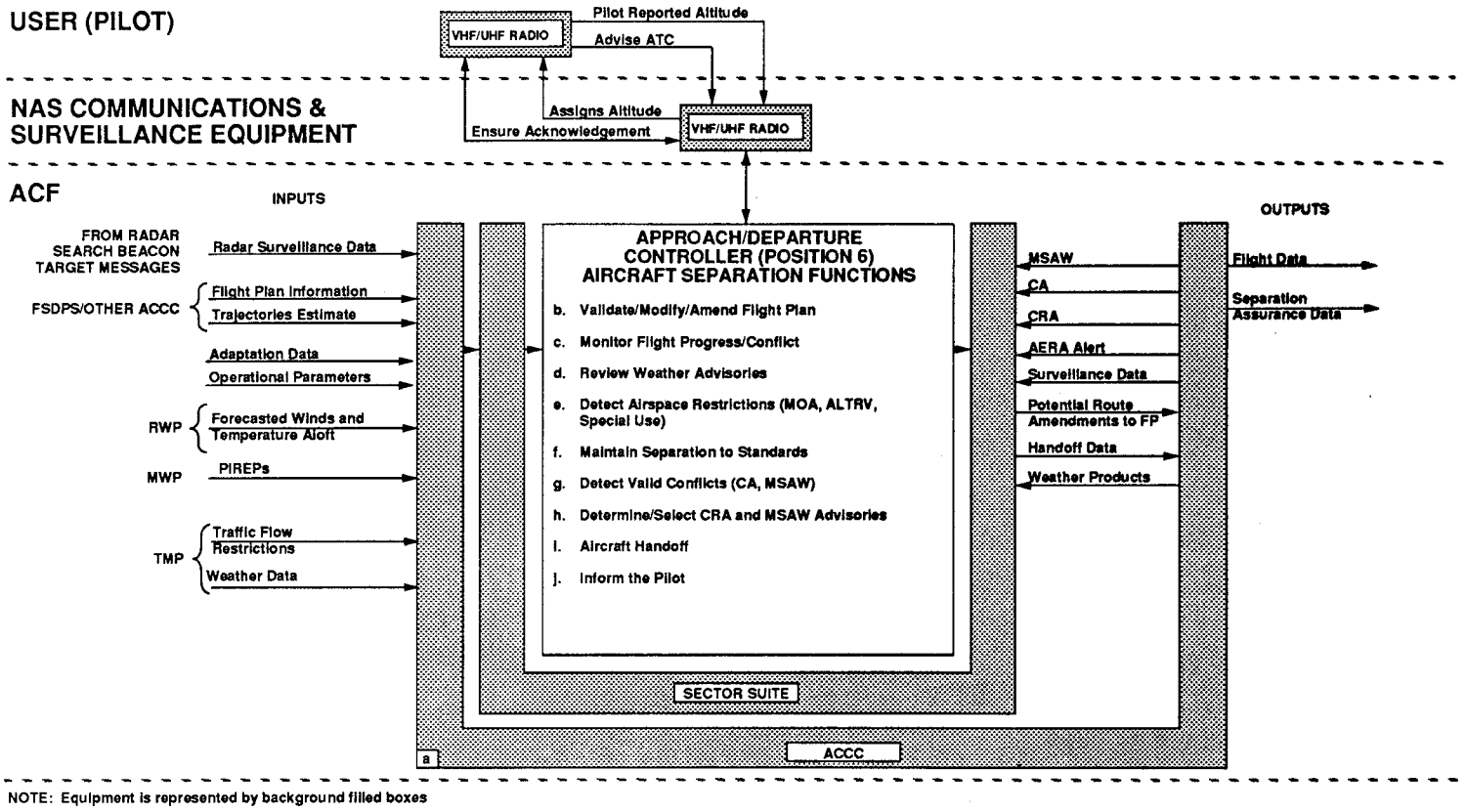
Figure 2-3 illustrates the aircraft separation functions and services provided by approach/departure controllers (position 6) at the ACFs. Functions are identified by lower case letters and are described in the corresponding paragraphs below.

a. ACCC Processing. The ACCC performs the following in support of the Approach/Departure Controller's functions:

- Receive and process surveillance messages from both Mode S radar beacon system sites and ATCRBS sites.
- Activate and drop IFR flight plans.
- Generate tracking for all tracks that were initiated automatically or manually.
- Accept, store, and process IFR and VFR flight data.
- Process CA, MSAW, and CRA, and report violations.
- Detect when a controlled track not in handoff to a sector and not previously pointed out to the sector enters that sector.
- Process weather data (see paragraph 2.2.1.c).

b. Validate/Modify/Amend Flight Plans. The controllers may retrieve the flight plan, modify it, and reenter it as a new flight plan. They have the capability to specify a trial plan or to designate the trial plan as a new flight plan.

NASSRS requirements: 3.2.3.B
3.2.3.H.4
3.2.3.O.2



NOTE: Equipment is represented by background filled boxes

FIGURE 2-3
APPROACH/DEPARTURE CONTROLLER FUNCTIONS FOR AIRCRAFT SEPARATION OPERATIONAL FLOW DIAGRAM

c. Monitor Flight Progress/Conflict. One of the functions of approach/departure controllers is to monitor the aircraft's flight progress when handoff occurs between them and en route controllers. The approach/departure controllers monitor the flight progress of all aircraft in their sectors. The controllers provide correction advisories to aircraft deviating from their planned route of flight. They display the planned route of any flight on the situation display for which flight plan information is available. After controllers have entered a trial plan or the ACCC has created a trial plan, controllers display the associated trial plan route of the aircraft. Conflicts or restriction violations are indicated on the alert display. If the alert display indicates no potential conflicts or violations, controllers may then initiate a flight plan.

NASSRS requirements: 3.2.3.A.1 (a & f)
3.2.3.A.4
3.2.3.B (5 & 6)
3.2.3.C
3.2.3.H (1, 2, 3, & 8)
3.2.3.O

d. Monitor Weather Advisories. Controllers monitor current and forecasted weather information using the sector suite to display alphanumeric and graphic weather data stored in the system. They respond to a pilot's request to deviate around a hazardous weather area and provide specific weather information such as altimeter settings and winds aloft. Data link processors relay weather information directly to the cockpit.

NASSRS requirements: 3.2.3.D
3.2.3.H.7

e. Detect Airspace Restrictions. The controllers detect estimated violations of airspace restrictions and reroute controlled aircraft to avoid the use of restricted airspace (special use airspace).

NASSRS requirements: 3.2.3.I.1
3.2.3.L.6

f. Maintain Separation Standards. The controllers ensure separation minima (the minimum longitudinal, lateral, or vertical distances by which aircraft are spaced through the application of ATC procedures) in a radar environment. This function is performed on a continuous basis.

NASSRS requirements: 3.2.3

g. Detect Valid CA and MSAW. The ACCC detects CAs and MSAWs, and displays the alert messages to controllers on the alert display.

NASSRS requirements: 3.2.5.K.1.a
3.2.3.L (3 & 7)

h. Determine/Select CRA and MSAW Advisories. The controllers review the CRA and MSAW advisories at their sector suites. These ACCC generated advisories represent recommended maneuvers to solve the identified conflicts. The ACCC displays a rank ordered list of maneuvers for each predicted conflict. The controller either picks one of these maneuvers or formulates his/her own maneuver.

NASSRS requirements: 3.2.3.K.2
3.2.3.L.7

i. Aircraft Handoff. Transfer of aircraft radar identification between two radar controllers is referred to as a handoff. As an aircraft progresses through the system its radar identification is transferred from one ACF/sector to the next ACF/sector. This transfer causes all flight information to be transmitted from the sending facility/sector to the receiving facility/sector. If further identification of an approaching aircraft is necessary, the controllers may contact the pilot and request identity confirmation. The receiving controllers then acknowledge all transfers either by voice or through the entry of computer messages. Handoffs also occur between the approach/departure controllers and en route controllers resident in the same facility, and between approach/departure controllers and local controllers.

NASSRS requirements: 3.2.3.H.3
3.2.3.O (1 & 2)

j. Inform The Pilot. The controller informs the pilot of the primary threats and the recommended maneuver based on the selected conflict resolution.

NASSRS requirements: 3.2.3.K (3 & 5)

2.3.2 Functions of En Route Controllers (Position 7)

Figure 2-4 illustrates the aircraft separation functions and services provided by the en route controller (position 7) at the ACF. Lower case letters identify the functions performed by the controllers and their support equipment, and are described in the corresponding paragraphs below.

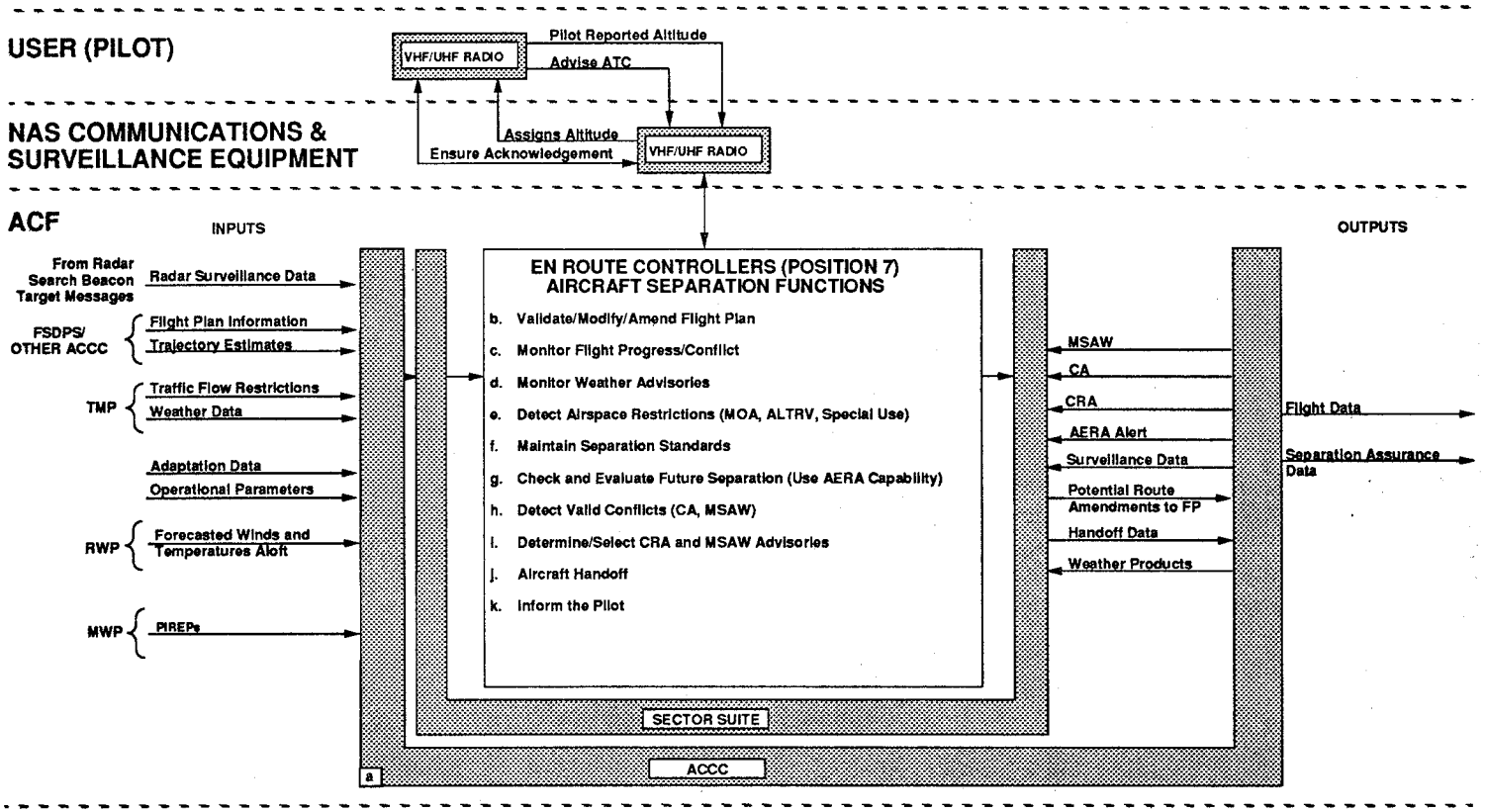


FIGURE 2-4
EN ROUTE CONTROLLER FUNCTIONS FOR
AIRCRAFT SEPARATION OPERATIONAL FLOW DIAGRAM

a. ACCC Processing. In support of the en route controller's functions related to aircraft separation, the ACCC performs the items listed in paragraph 2.3.1.a.

b. Validate/Modify/Amend Flight Plans. See Paragraph 2.3.1.b

c. Monitor Flight Progress/Conflict. See Paragraph 2.3.1.c

d. Review Weather Advisories. See Paragraph 2.3.1.d

e. Detect Airspace Restrictions. See Paragraph 2.3.1.e

f. Maintain Separation Standards. See Paragraph 2.3.1.f

g. Check and Evaluate Future Separation (use of AERA capabilities). The controllers may compare flight path projection and detect potential conflicts (automated problem detection, (APD)) for 20 minutes in advance. For all AERA alerts (priority or advisory) the controllers may also formulate problem resolutions.

NASSRS requirements: 3.2.3.A (2 & 3)
3.2.3.B (5 & 6)
3.2.3.C.2
3.2.3.H.9
3.2.3.K (2 & 3)
3.2.3.L (1, 2, 4, & 5)

h. Detect Valid Conflicts (CA, MSAW). See Paragraph 2.3.1.g

i. Determine/Select CRA and MSAW Advisories. See Paragraph 2.3.1.h

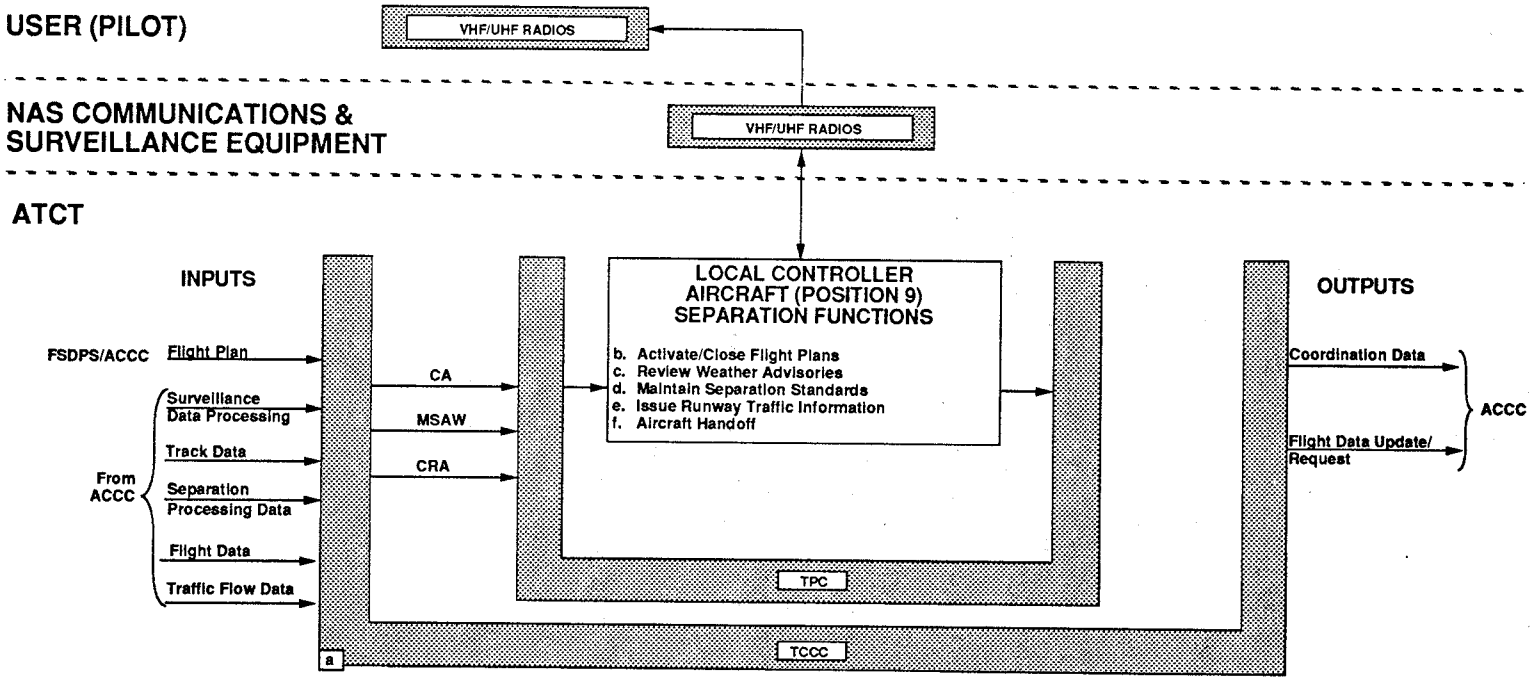
j. Aircraft Handoff. See Paragraph 2.3.1.i

k. Inform The Pilot. See Paragraph 2.3.1.j

2.3.3 Functions of Local Controllers (Position 9)

Figure 2-5 illustrates the functions and services provided by the local controller (position 9) at an ATCT. The functions are identified by lower case letters and are described in the corresponding paragraphs below.

a. TCCC Processing. The TCCC provides an automated information system to support the ATCT controllers by providing an interface with an ACCC at a parent ACF. External data received by the TCCC includes surveillance data, separation assurance assistance data, airport environment data, and flight plan data. The TCCC has two



NOTE: Equipment is represented by background filled boxes

FIGURE 2-5
LOCAL CONTROLLER FUNCTIONS FOR AIRCRAFT
SEPARATION OPERATIONAL FLOW DIAGRAM

modes of operation: normal and stand-alone. The TCCC transitions to the stand-alone mode of operation when communications with an ACCC become unavailable. Separation assurance automation capabilities are not provided in the stand-alone mode.

b. Activate/Close Flight Plans. In towers without a TCCC, the controller may activate and close an IFR flight plan by contacting the appropriate ACF controller. If requested by the pilot, the controller may activate and/or close a VFR flight plan by contacting the Automated Flight Service Station (AFSS).

NASSRS requirements: 3.2.3.B
3.2.3.H.4
3.2.3.O.2

c. Review Weather Advisories. In addition to reviewing the weather advisories in paragraph 2.3.1.d, they are also responsible for providing wind shear alert information to pilots.

d. Maintain Separation Standards. The controllers provide separation by spacing aircraft that are landing and taking off.

NASSRS requirements: 3.2.3.ALL

e. Issue Runway Traffic Information. In order to ensure aircraft separation, the local controllers consider the conditions of runways available for use. They keep arriving aircraft informed of runway traffic information, and notify pilots of aircraft crossing or departing the runway.

NASSRS requirements: 3.2.3.I

f. Aircraft Handoff. The local controller accepts/hands-off/ transfers control of the aircraft to/from the approach/departure or en route controller (depending on the relationship of the particular tower with the ACF).

2.4 Correlation with Operational Requirements

Table 2-1 summarizes the correlation of the aircraft separation operational requirements paragraphs of NAS-SR-1000 with the previous paragraphs in this document that describe the functions performed by the controllers and the information generated/displayed by the ACCC/TCCC. Aircraft separation paragraphs from Section 3.2.3 of NASSRS which are introductory in nature, do not state an explicit operational requirement, or which reference other portions of NAS-SR-1000, are indicated with a dash. A correlation shown between the requirements paragraph and a paragraph describing the information and functions performed does not indicate that the requirement is fulfilled.

TABLE 2-1
AIRCRAFT SEPARATION OPERATIONAL REQUIREMENTS CORRELATION

NAS-SR-1000 Paragraph		Information										Approach/Departure Controller												En Route Controller															Local Controller					
		ACCC					TCCC																																						
Paragraph		2.2.1.a	2.2.1.b	2.2.1.c	2.2.1.d	2.2.1.e	2.2.2.a	2.2.2.b	2.2.2.c	2.2.2.d	2.3.1.a	2.3.1.b	2.3.1.c	2.3.1.d	2.3.1.e	2.3.1.f	2.3.1.g	2.3.1.h	2.3.1.i	2.3.1.j	2.3.1.k	2.3.2.a	2.3.2.b	2.3.2.c	2.3.2.d	2.3.2.e	2.3.2.f	2.3.2.g	2.3.2.h	2.3.2.i	2.3.2.j	2.3.2.k	2.3.2.l	2.3.2.m	2.3.4.a	2.3.4.b	2.3.4.c	2.3.4.d	2.3.4.e	2.3.4.f
3.2.3	Aircraft Separation										X																																
.A	Acquire Actual Flight Information																																											
.A.1.a	Aircraft Position/En Route										X											X																						
.A.1.b	Aircraft Position/Terminal										X											X													X								
.A.1.c	Speed/En Route										X											X																						
.A.1.d	Speed/Terminal																																		X								
.A.1.e	Reported Altitude		X					X			X											X													X								
.A.1.f	Aircraft Track	X					X				X		X									X		X											X								
.A.2	Project Flight Paths (20 Minutes)										X						X										X																
.A.3	Update Flight Position		X					X			X						X					X						X															
.A.4	Flight Information										X		X											X													X							
.B	Acquire Flight Plan Information																																											
.B.1	Validate Flight Plans										X	X										X	X													X	X						
.B.2	All IFR Aircraft										X	X										X	X													X	X						
.B.3	Update Flight Plan		X								X	X										X	X													X	X						
.B.4	Provide Clearance to Facility Not Constrained by Physical ATC		X								X	X										X	X													X	X						
.B.5	Provide Clearance to Valid Flight Plans										X		X				X							X			X																
.B.6	Create/Maintain 4-Dimensional Trajectory										X		X				X							X			X																
.B.7	Process Alternative Clearances		X		X						X											X							X														
.C	Flight Plan Association Checks										X																																
.C.1	Project Flight Paths	X					X				X											X																						
.C.2	Provide 4-Dimensional Trajectory				X						X						X										X																
.C.3	Conformation Criteria				X						X						X					X																					
.C.4	Trial Plan				X						X																X																
.C.5	Reminders to Specialist										X											X																						
.C.6	Alert the Specialist	X									X											X																						
.D	Weather Information for Flight Path Prediction										X																																
.D.1	Weather Product				X					X	X		X											X													X						
.D.2	Use of Weather Data (Current, Forecast)				X					X	X		X											X													X						
.D.3	Display Seven Level of Precipitation Intensity										X											X																						
.E	Detection of ADIZ, DEWIZ Zone																																											
.F	Separation of A/C in Parallel Runways						X				X																														X	X	
.F.1	Runway 2500 Feet Apart/Successive A/C										X																														X	X	
.F.2	Runway 4300 Feet Apart/Simultaneous A/C										X																														X	X	

TABLE 2-1
AIRCRAFT SEPARATION OPERATIONAL REQUIREMENTS CORRELATION
(CONTINUED)

NAS-SR-1000 Paragraph / Paragraph	Information									Approach/Departure Controller												En Route Controller																Local Controller					
	ACCC					TCCC																																					
	2.2.1.a	2.2.1.b	2.2.1.c	2.2.1.d	2.2.1.e	2.2.2.a	2.2.2.b	2.2.2.c	2.2.2.d	2.3.1.a	2.3.1.b	2.3.1.c	2.3.1.d	2.3.1.e	2.3.1.f	2.3.1.g	2.3.1.h	2.3.1.i	2.3.1.j	2.3.1.k	2.3.2.a	2.3.2.b	2.3.2.c	2.3.2.d	2.3.2.e	2.3.2.f	2.3.2.g	2.3.2.h	2.3.2.i	2.3.2.j	2.3.2.k	2.3.2.l	2.3.2.m	2.3.4.a	2.3.4.b	2.3.4.c	2.3.4.d	2.3.4.e	2.3.4.f
3.2.3 .G Provide Surveillance Coverage										X					X						X					X							X				X			
.G.1 En Route Area without Mode S																																										
.G.2 Terminal Area without Mode S																																										
.G.3 En Route Area with Mode S																																										
.G.4 Terminal Area with Mode S																																										
.G.5 Response Time																																										
.G.6 Update Actual Flight Position																																										
.G.7 Coverage in Alaska																																										
.H Display Controlled A/C Position and Related Data												X																						X								
.H.1 Flight Data Entry Contents	X	X				X	X			X		X									X		X										X								
.H.2 Inhibit/Reposition Display Information		X					X			X		X									X		X										X							X	
.H.3 Flight Plan Information under Control/About to Enter Sector		X					X			X	X								X		X	X								X										
.H.4 Display Flight Plan Data		X					X			X											X													X	X						
.H.5 Capacity of Flight Data Display										X											X													X							
.H.6 Record/Maintain a History										X											X									X				X							
.H.7 Capability to Discriminate Display Information										X	X										X													X							
.H.8 Display Critical Information										X											X	X													X							
.H.9 Display Priority or Advisory Alert																X												X													
.I Display Geographical Information																					X																					
.I.1 Display Information on Special Use Airspace										X				X										X																X	
.I.2 Display Geographic Map Data		X					X														X																			X	
.J Tracking Performance Requirements	X					X				X											X																				
.K Generate Clearances			X					X									X	X			X					X		X		X											
.K.1 Provide Clearances										X						X		X			X						X	X		X											
.K.2 Deliver Clearances																X											X														
.K.3 Clearance via Data Link										X									X	X	X											X									
.K.4 Alert the Specialist (Conformance Criteria)																			X																						
.K.5 Notify Users																																										
.L Detect Actual/Potential A/C Separation										X						X					X						X														
.L.1 Update Flight Plan										X					X	X					X					X	X														
.L.2 Compare/Project (20 Minutes) Flight Path in Advance										X							X				X							X													
.L.3 Detect CA in Terminal/En Route	X					X				X						X					X						X														
.L.4 Alert Symbol (Actual and Potential)	X					X				X						X					X						X														
.L.5 Priority/Advisory Messages																																										

TABLE 2-1
AIRCRAFT SEPARATION OPERATIONAL REQUIREMENTS CORRELATION
(CONCLUDED)

NAS-SR-1000 Paragraph / Paragraph	Information								Approach/Departure Controller												En Route Controller																	Local Controller				
	ACCC					TCCC																																				
	2.2.1.a	2.2.1.b	2.2.1.c	2.2.1.d	2.2.1.e	2.2.2.a	2.2.2.b	2.2.2.c	2.2.2.d	2.3.1.a	2.3.1.b	2.3.1.c	2.3.1.d	2.3.1.e	2.3.1.f	2.3.1.g	2.3.1.h	2.3.1.i	2.3.1.j	2.3.1.k	2.3.2.a	2.3.2.b	2.3.2.c	2.3.2.d	2.3.2.e	2.3.2.f	2.3.2.g	2.3.2.h	2.3.2.i	2.3.2.j	2.3.2.k	2.3.2.l	2.3.2.m	2.3.4.a	2.3.4.b	2.3.4.c	2.3.4.d	2.3.4.e	2.3.4.f
3.2.3 .L.6 Inhibit Alerts for MARSA and ALTRV Conditions										X											X			X																
.L.7 Provide Collision Risk Assessment (e.g., CRA)	X					X				X								X			X							X	X		X			X						
.M Generate Resolution Advisories	X	-	-	-	-	X	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	X	-	-	-	-	
.N Detect and Identify Conflict	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	X	-	-	-	-	
.O Aircraft Handoff	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	
.O.1 Provide Handoff with no Loss of Separation																			X												X								
.O.2 Alert a Receiving Specialist										X									X		X	X									X			X					
.O.3 Automatic Handoff																			X		X										X								
.P Available on a Continuous Basis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

2.5 Operational Sequences

Figures 2-6 to 2-8 illustrate a common sequencing of the functions described in Section 2.3 and show how the various specialists interact with the user, other specialists, and NAS subsystems to provide aircraft separation. Figure 2-6 shows a general sequence of operator/user interactions within the ACF environment to check and evaluate aircraft separation in controlled airspace. Figure 2-7 shows aircraft conflict resolutions to ensure separation in en route airspace. Figure 2-8 illustrates the aircraft separation and conflict resolution operational sequences in terminal airspace. In order to ensure separation, specialists advise only controlled aircraft. In the automated environment, AERA services can be extended to VFR aircraft in which the pilot has filed a flight plan requesting ATC separation service. The number in the upper right hand corner of the action rectangles and upper vertices of the decision diamonds are reference numbers and progress more or less as time progresses during the operation. The cross hatching indicates an interaction with, and processing by, automatic data processing equipment (ACCC/TCCC).

2.5.1 Checking and Evaluating Aircraft Separation for ACF Controllers

Figure 2-6 describes the complete spectrum of aircraft separation operations in terms of functional activities in the ACF environment for all controllers. Each major activity is divided into sub-activities (double numbers in the figure) to describe complete controller and system interactions with respect to aircraft separation. The major activities are aligned vertically on Figure 2-6 to indicate that there is no specific time sequence in which they are performed. The functions are performed repeatedly as required to assure safe aircraft-to-aircraft and aircraft-to-airspace separation. These are general functions performed by all ACF controllers, and some controllers may perform more or less of these functions depending on position responsibilities.

The ACF controllers review the flight data display for future aircraft separation (1) and receive flight plan changes (1.1) from the pilot (1.1.1). The ACF controllers enter flight plan amendments into the ACCC (1.2), and receive pilot position reports (1.3). They evaluate flight data and determine a future course of action (1.3). They construct and amend the trial plan via the ACCC (1.4), and then evaluate the trial plan results (1.5). The ACF controllers review the situation display for potential violation of flow restrictions (2). They receive and review metering data with the support of the Traffic Management Unit (TMU) (2.1). They review their display for potential violations of lateral and altitude conformance criteria (3), and detect non-conformance when displayed by the ACCC (3.1). The ACF controllers request and observe real time weather information (4), determine any weather impact on routes and flow plans (4.1), and issue

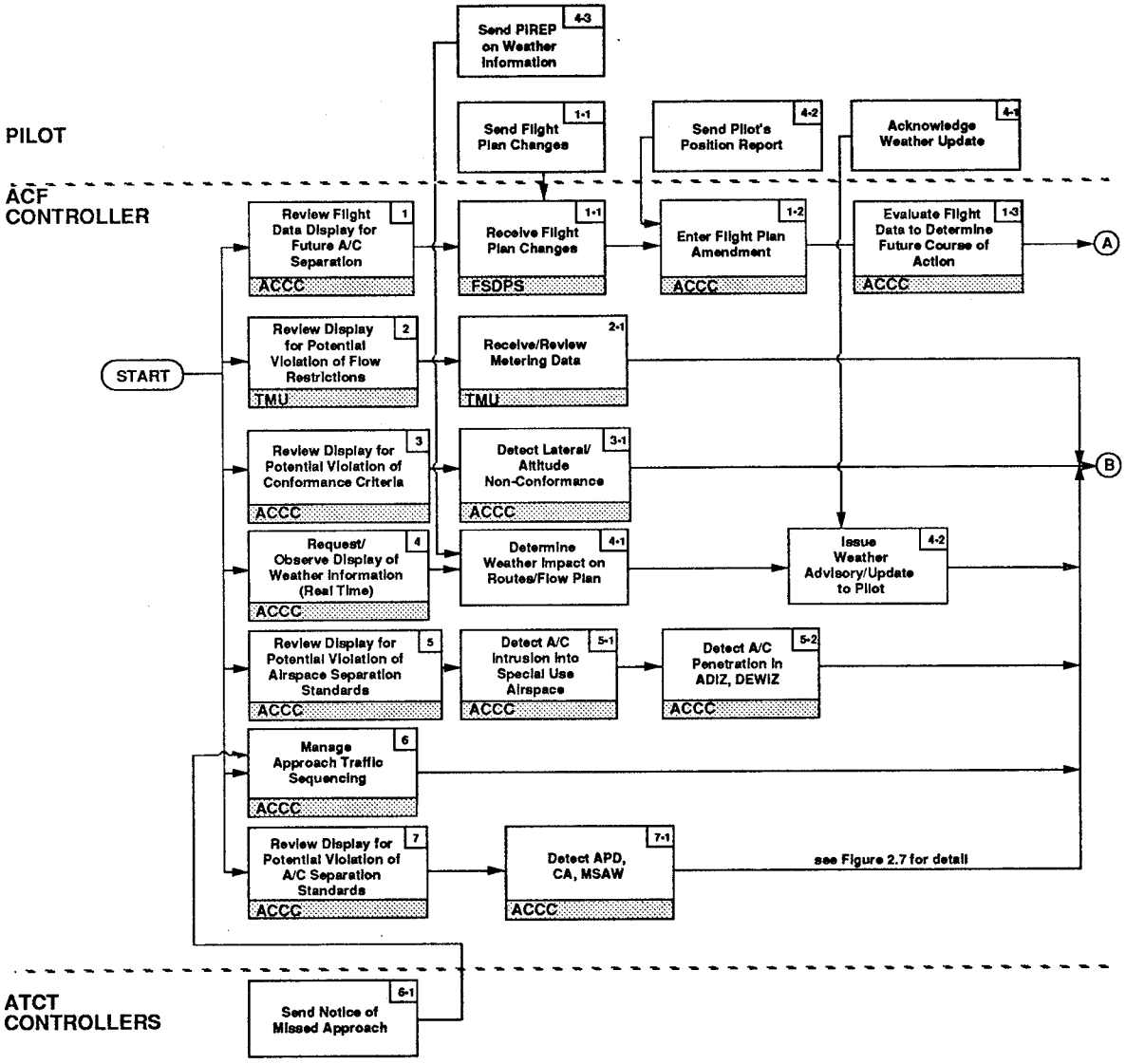


FIGURE 2-6
CHECKING AND EVALUATING AIRCRAFT SEPARATION FOR ACF CONTROLLERS OPERATIONAL SEQUENCE DIAGRAM

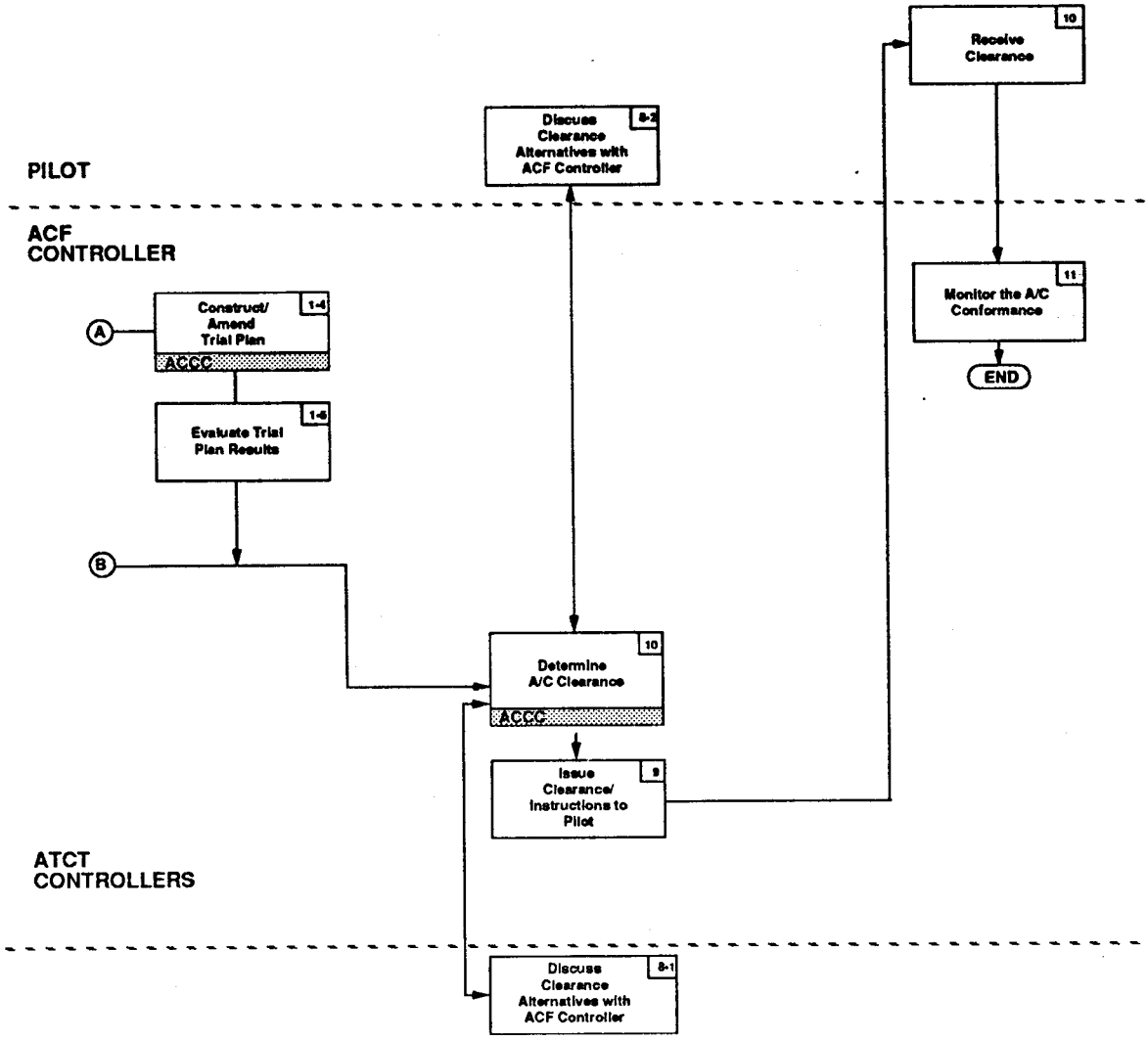


FIGURE 2-6
CHECKING AND EVALUATING AIRCRAFT SEPARATION FOR ACF CONTROLLERS OPERATIONAL SEQUENCE DIAGRAM (CONCLUDED)

weather advisories and updates to the pilot (4.2). The ACF controllers review the display for potential violations of airspace separation standards (5). This includes the detection of aircraft intruding into special use airspace (5.1), and aircraft penetrating the ADIZ and DEWIZ (5.2). ACF controllers manage approach traffic sequencing with the support of ACCC (6), and receive notices of missed approaches from the ATCT controllers (6.1).

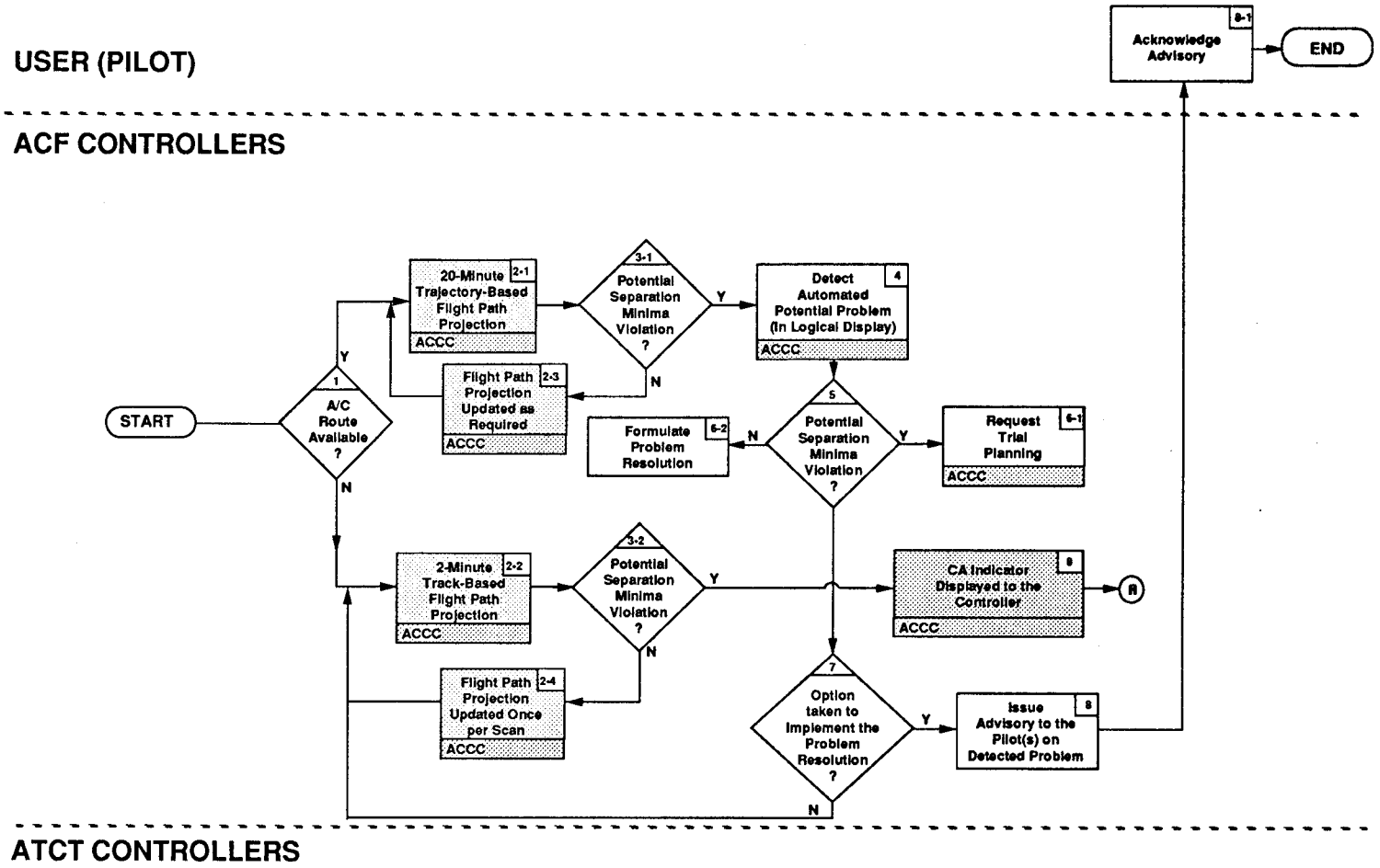
The ACF controllers review the situation display for potential violations of aircraft separation standards (7), and with the support of ACCC (APD, CA, and MSAW (7.1)), they detect various conflicts.

The ACF controllers determine aircraft clearances sometimes with the assistance of an automated plan from the ACCC (8), and sometimes by discussing clearance alternatives with the ATCT controllers (8.1) and the pilot (8.2). The ACF controllers issue clearance instructions to the pilot (9). The pilot receives the clearance (10), and finally, the ACF controllers monitor the aircraft conformance with the clearance (11).

2.5.2 Aircraft Conflict Resolution for ACF Controllers

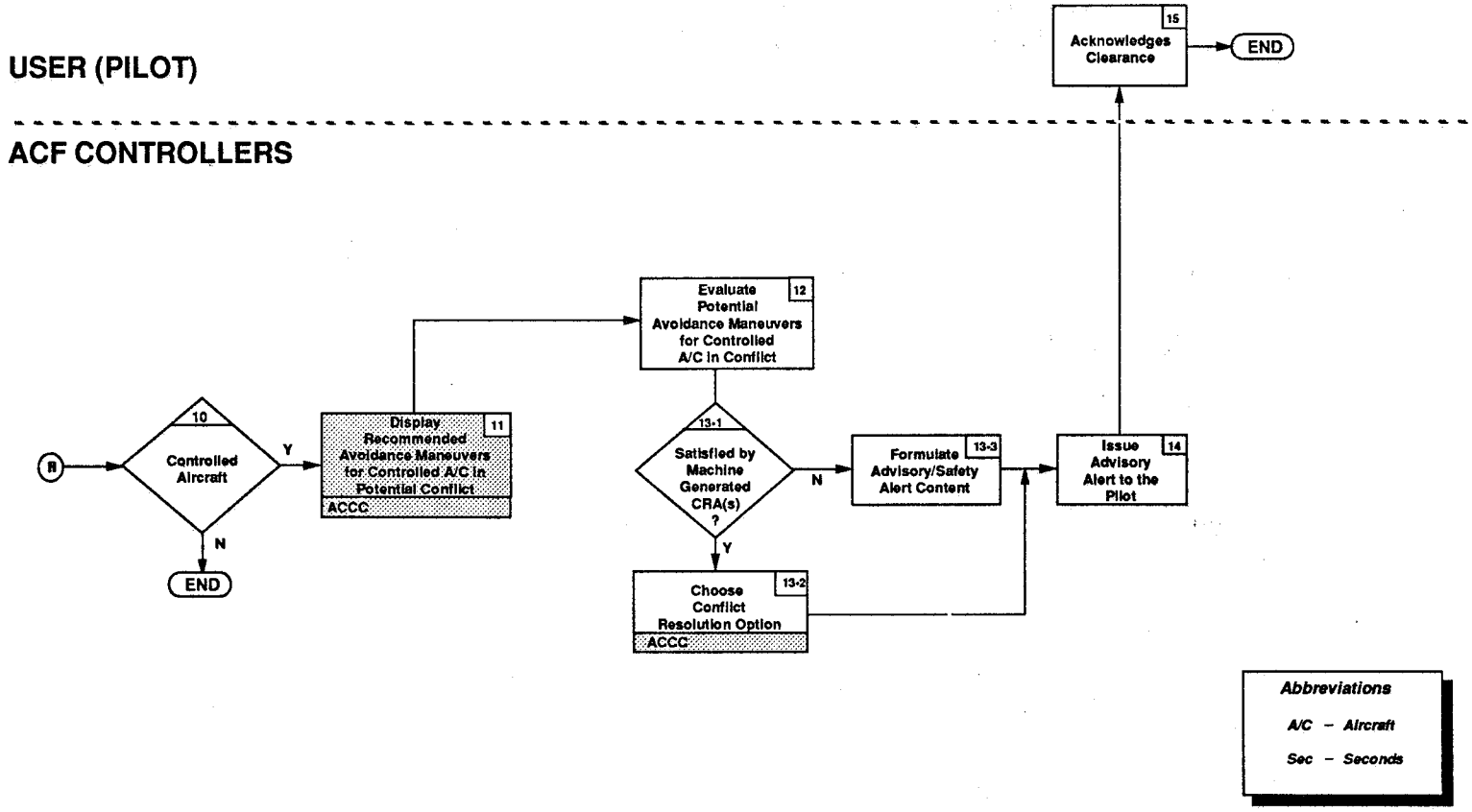
Figure 2-7 illustrates the interactions necessary to issue appropriate advice for controlled aircraft to maneuver and avoid aircraft-to-aircraft conflicts (out to a time horizon of about 20 minutes) and CA (imminent conflicts less than two minutes to violation) to ensure aircraft separation.

An aircraft routing may or may not be available to a controller (i.e., no flight plan is available for uncontrolled VFR) (1). If routing information is available (IFR and controlled VFR), the controller may consider the entire 20 minute trajectory based on flight path projection into the future by the ACCC (2.1), which is updated as required (the conditions are stated in the system database) (2.3). If a potential separation minima violation takes place (3.1), it may lead to the use of other automation tools which are provided by the ACCC. The controller may detect the APD (AERA alert) and may also detect priority or advisory alerts (AERA alerts), all of which are displayed on the sector suites (4). A request for trial planning may be made (5), or the controller may self-formulate a resolution to the alert (6). It is the controller's option to implement the problem resolution (7). If the controller implements the resolution, then he/she issues a clearance to the pilot (8); otherwise, the controller may consider only a 2 minute track projection-based flight path (2.2). This projection is updated using surveillance data at least once per scan (2.4).



NOTE: Equipment is represented by background-filled boxes

FIGURE 2-7
AIRCRAFT CONFLICT RESOLUTION FOR AIRCRAFT SEPARATION OPERATIONAL SEQUENCE DIAGRAM



NOTE: Equipment is represented by background-filled boxes

FIGURE 2-7
AIRCRAFT CONFLICT RESOLUTION FOR AIRCRAFT SEPARATION OPERATIONAL SEQUENCE DIAGRAM (CONCLUDED)

For all aircraft, if a potential separation minima violation is indicated (3.2) in the short look-ahead time frame (typically 2 minutes or less), then a CA is displayed to the controller by the ACCC (9); and if the aircraft is controlled (10), recommended avoidance maneuvers are displayed to the controller by the ACCC (11). Next, the ACF controller evaluates the potential avoidance maneuvers for controlled aircraft in conflict after suppressing the nuisance alerts and resolutions (12). If the ACCC generates conflict resolutions (13.1) that the controller is satisfied with, then a conflict resolution is chosen (13.2) or a resolution is formulated. The controller issues a clearance to the pilot (14), informing the pilot of the relative positions of the primary threats, and then the pilot acknowledges the clearance (15).

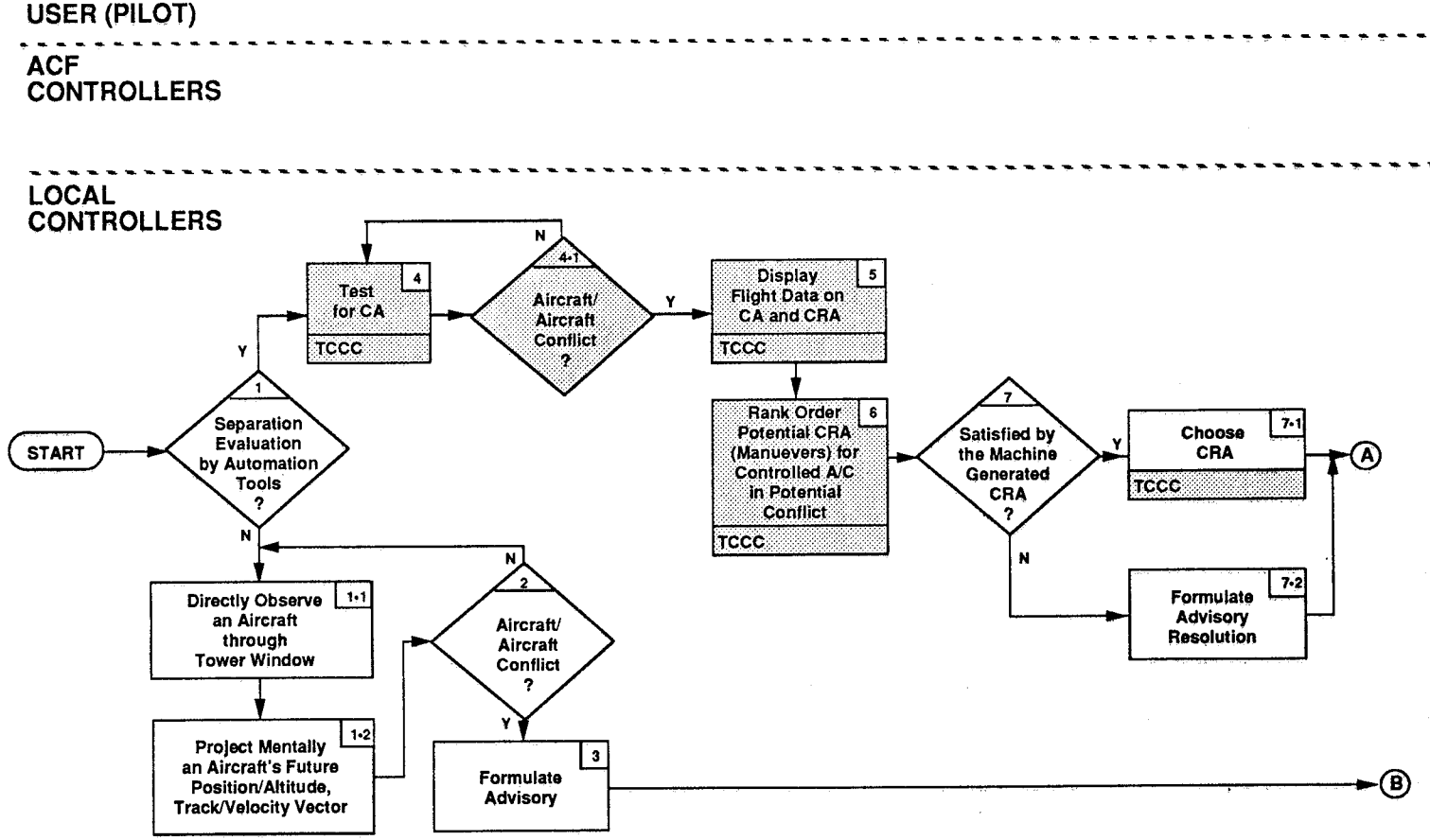
2.5.3 Aircraft Separation Assurance and Conflict Resolution for Local Controllers

Figure 2-8 illustrates a general sequence of operator/user interactions necessary to issue an appropriate maneuver to controlled aircraft to ensure separation.

Depending on the weather and how close the aircraft is, the conflict may be detected visually or only by radar and the CA function (1). If it is directly observable through the window of the tower cab, the local controller mentally projects the aircraft's future position/altitude and estimates its track/velocity vector. To do this, he/she may refer to the radar/beacon data presented on their display (1.2). If a potential conflict is determined (2), the controller formulates an advisory and resolution to the potential conflict (3). If the conflict is detected by the CA function, the TCCC displays the flight data (flight plans, and flight plan amendments) (4), and the CA and CRA (5). Possible CRA maneuvers for controlled aircraft involved in the predicted conflict are ranked by the ACCC and sent to the TCCC (6). If the conflict is valid and the local controller is satisfied by the machine generated conflict resolutions (7), he/she chooses a CRA (7.1); otherwise, the controller formulates his/her own advisory/resolution (7.2). If the situation warrants, the local controller advises the appropriate ACF controllers on the conflict situation, including the positions of primary threats (8.1) and also issues a clearance to the pilot (8.2). Finally, the pilot acknowledges the advisory (9).

2.6 Operational Scenario

The operational scenario presents a specific hypothetical situation. It is similar to the sequence diagrams in Figures 2-6, 2-7, and 2-8; however, the scenario shows more detail and shows only one branch where a decision is made. Figure 2-9 illustrates two data link equipped aircraft (Pan Am 940 and United Airlines (UAL) Flight 300) that are involved in a predicted possible violation of separation minima.



NOTE: Equipment is represented by background-filled boxes

FIGURE 2-8
AIRCRAFT SEPARATION ASSURANCE AND CONFLICT RESOLUTION
FOR LOCAL CONTROLLER OPERATIONAL SEQUENCE DIAGRAM

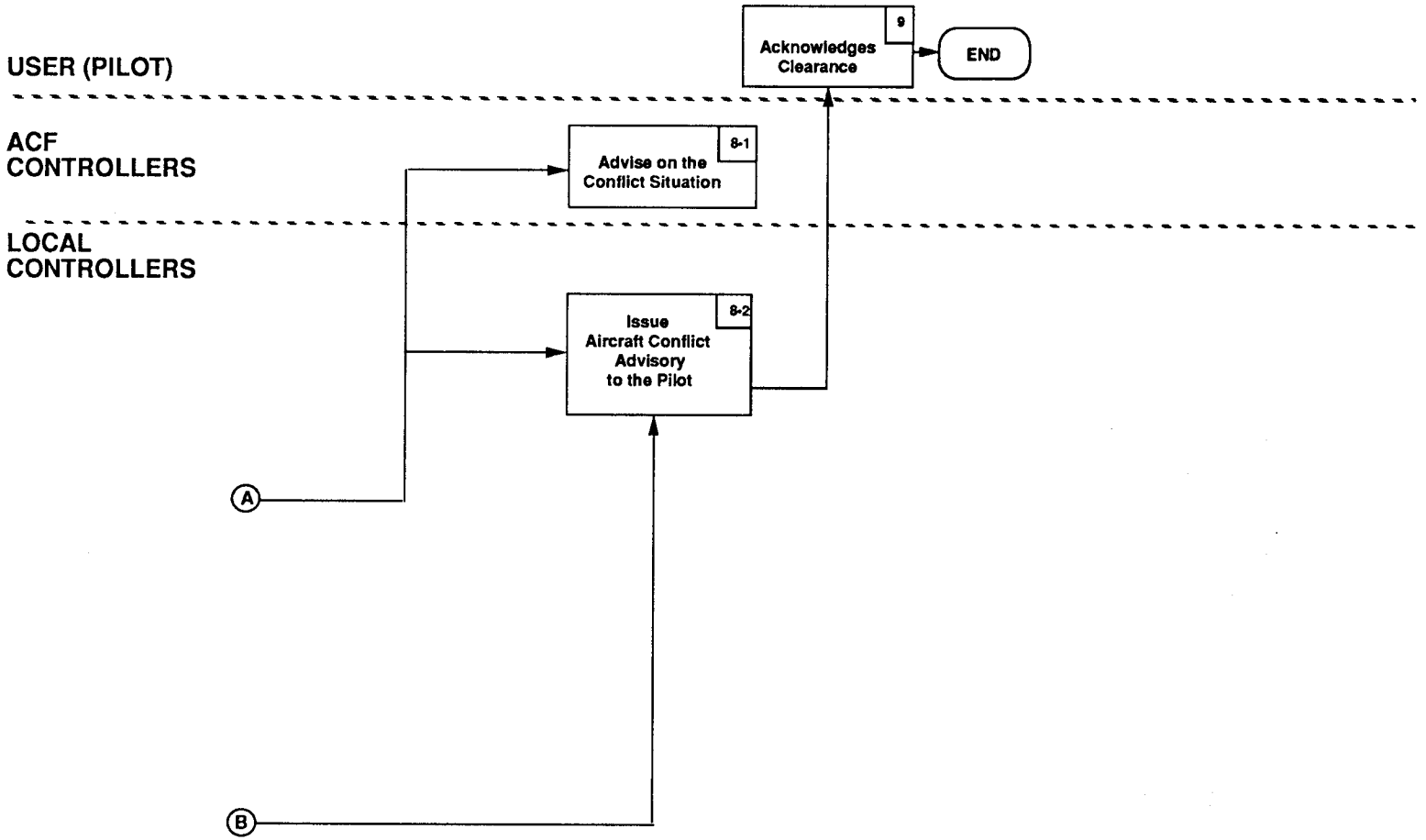


FIGURE 2-8
AIRCRAFT SEPARATION ASSURANCE AND CONFLICT RESOLUTION
FOR LOCAL CONTROLLER OPERATIONAL SEQUENCE DIAGRAM (CONCLUDED)

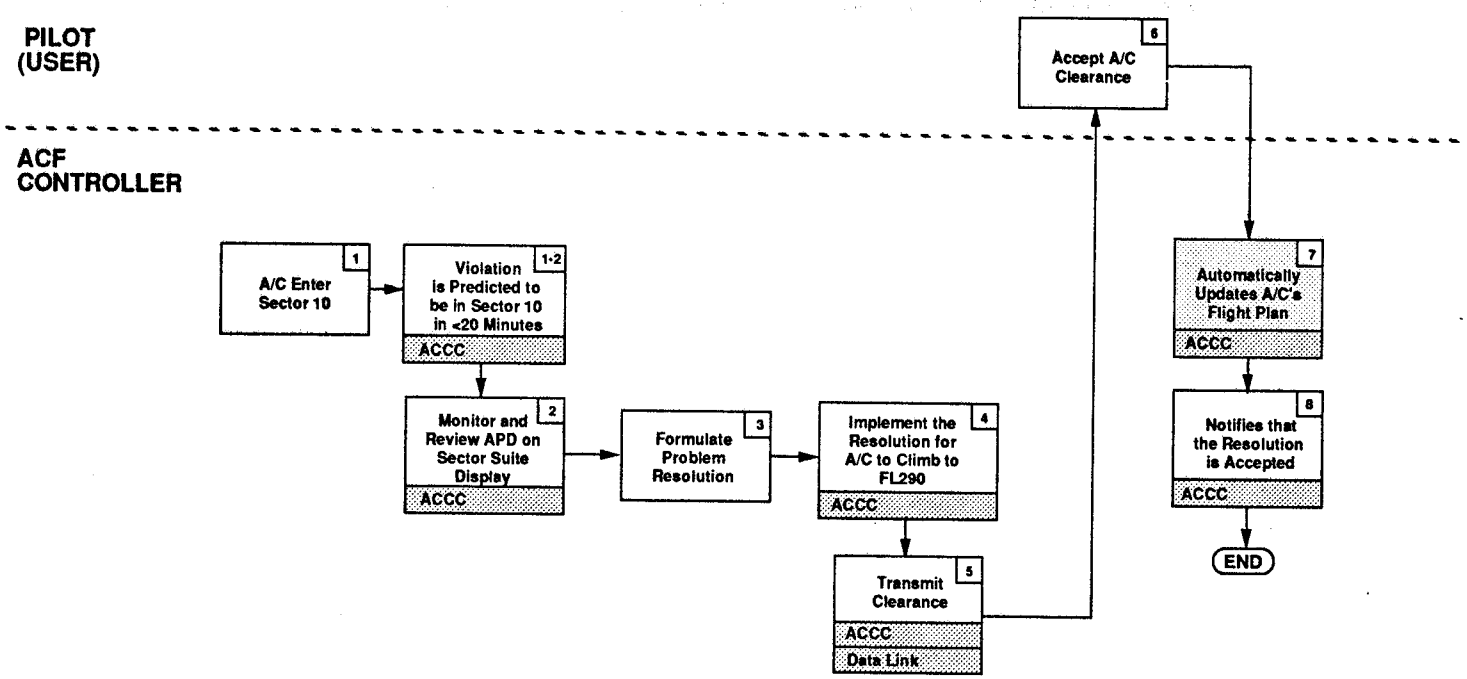


FIGURE 2-9
AIRCRAFT SEPARATION FOR 20 MINUTES
LOOK-AHEAD TIME OPERATIONAL SCENARIO DIAGRAM

Specifically, there is a predicted aircraft-to-aircraft conflict about 20 minutes into the future (an AERA alert). Both aircraft are in sector 10 and data link is used for delivery of the clearance. The controller responsible for sector 10 is controlling the UAL 300 and Pan Am 940 aircraft in conflict.

The aircraft pair is involved in an aircraft-to-aircraft conflict in sector 10 in controlled airspace (1). With the support of the ACCC, the point of violation is predicted to be in sector 10 in less than 20 minutes (1.2). The controller monitors and reviews the APD data on his sector suite (2). He then formulates a problem resolution to the APD (3). The controller, with the support of the ACCC, implements the resolution for UAL 300 to climb to Flight Level (FL) 290 (4). The controller instructs the automation system to use the data link capability to transmit the clearance to the aircraft (5). The pilot accepts the clearance by use of data link (6). The system automatically updates UAL 300's flight plan (7), and the system notifies the controller that the resolution is accepted (8).

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GLOSSARY

AAS	Advanced Automation System
A/C	Aircraft
ACARS	Automatic Communications Addressing and Reporting System
ACCC	Area Control Computer Complex
ACF	Area Control Facility
ADIZ	Air Defense Identification Zone
ADS	Automatic Dependent Surveillance
AERA	Automated En Route ATC
AFSS	Automated Flight Service Station
AIRMET	Airman's Meteorological Information
ALTRV	Altitude Reservation
A/N	Alphanumeric
APD	Automated Problem Detection
APP	Approach
ASDE	Airport Surface Detection Equipment
ASOS	Automated Surface Observing System
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
ATCRBS	Air Traffic Control Radar Beacon System
ATCT	Airport Traffic Control Tower
AWOS	Automated Weather Observation Station
AWP	Aviation Weather Processor
CA	Conflict Alert
CRA	Conflict Resolution Advisory
CWP	Central Weather Processor
CWSUM	Center Weather Service Unit Meteorologist
DEP	Departure
DEWIZ	Distance Early Warning Identification Zone
DLP	Data Link Processor
EARTS	En Route Automated Radar Tracking System
FAA	Federal Aviation Administration
FDB	Full Data Block
FDE	Flight Data Entry
FL	Flight Level
FP	Flight Plan
FSAS	Flight Service Automation System
FSDPS	Flight Service Data Processing System
HF	High Frequency
IFR	Instrument Flight Rules

LLWAS	Low-Level Wind Shear Alert System
MOA	Military Operations Area
Mode C	Mode C Transponder
Mode S	Mode Select Beacon System
MSAW	Minimum Safe Altitude Warning
MWP	Meteorologist Weather Processor
NAS	National Airspace System
NASSRS	NAS System Requirements Specification
NAWAU	National Aviation Weather Advisory Unit
NAWPF	National Aviation Weather Processor Facility
NEXRAD	Next Generation Weather Radar
nmi	Nautical miles
NWS	National Weather Service
ODAPS	Oceanic Display and Planning System
PIREP	Pilot Report
RCF	Remote Communications Facility
RVR	Runway Visual Range
RWP	Real-time Weather Processor
Sec	Seconds
SIGMET	Significant Meteorological Information
TCCC	Tower Control Computer Complex
TCS	Tower Communications System
TDWR	Terminal Doppler Weather Radar
TMP	Traffic Management Processor
TMU	Traffic Management Unit
TPC	TCCC Position Console
TRACON	Terminal Radar Approach Control
UAL	United Airlines
UHF	Ultra High Frequency
VHF	Very High Frequency
VFR	Visual Flight Rules
VSCS	Voice Switching and Control System
WCP	Weather Communications Processor
WMSCR	Weather Message Switching Center Replacement
WX	Weather

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